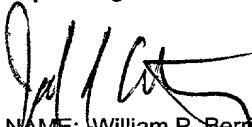


(1390 REV. 5-93) US DEPT. OF COMMERCE PATENT & TRADEMARK OFFICE		ATTORNEY'S DOCKET NUMBER 100983
<b>TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371</b>		U.S. APPLICATION NO. (if known, sec 37 C.F.R.1.5) <b>09/101508</b>
INTERNATIONAL APPLICATION NO. PCT/FR96/02035	INTERNATIONAL FILING DATE December 20, 1996	PRIORITY DATE CLAIMED December 21, 1995
TITLE OF INVENTION DISPOSITIF D'AMORCAGE A TEMPS PROGRAMMABLE		
APPLICANT(S) FOR DO/EO/US Jean-Louis BOYER and Joseph Nestor Andre GILSON		
Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:		
<ol style="list-style-type: none"> <li><input checked="" type="checkbox"/> This is a <b>FIRST</b> submission of items concerning a filing under 35 U.S.C. 371.</li> <li><input type="checkbox"/> This is a <b>SECOND</b> or <b>SUBSEQUENT</b> submission of items concerning a filing under 35 U.S.C. 371.</li> <li><input checked="" type="checkbox"/> This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).</li> <li><input checked="" type="checkbox"/> A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.</li> <li><input checked="" type="checkbox"/> A copy of the International Application as filed (35 U.S.C. 371(c)(2))             <ol style="list-style-type: none"> <li>a. <input checked="" type="checkbox"/> is transmitted herewith (required only if not transmitted by the International Bureau).</li> <li>b. <input checked="" type="checkbox"/> has been transmitted by the International Bureau.</li> <li>c. <input type="checkbox"/> is not required, as the application was filed in the United States Receiving Office (RO/US)</li> </ol> </li> <li><input type="checkbox"/> A translation of the International Application into English (35 U.S.C. 371(c)(2)).</li> <li><input type="checkbox"/> Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))             <ol style="list-style-type: none"> <li>a. <input type="checkbox"/> are transmitted herewith (required only if not transmitted by the International Bureau).</li> <li>b. <input type="checkbox"/> have been transmitted by the International Bureau.</li> <li>c. <input type="checkbox"/> have not been made; however, the time limit for making such amendments has NOT expired.</li> <li>d. <input type="checkbox"/> have not been made and will not be made.</li> </ol> </li> <li><input type="checkbox"/> A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).</li> <li><input type="checkbox"/> An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).</li> <li><input type="checkbox"/> A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)).</li> </ol>		
<b>Items 11. to 16. below concern other document(s) or information included:</b>		
<ol style="list-style-type: none"> <li>11. <input type="checkbox"/> An Information Disclosure Statement under 37 CFR 1.97 and 1.98.</li> <li>12. <input type="checkbox"/> An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.</li> <li>13. <input type="checkbox"/> A FIRST preliminary amendment.              <input type="checkbox"/> A SECOND or SUBSEQUENT preliminary amendment.</li> <li>14. <input type="checkbox"/> A substitute specification.</li> <li>15. <input type="checkbox"/> A small entity statement.</li> <li>16. <input checked="" type="checkbox"/> Other items or information: Petition to Revive Unintentionally Abandoned Application</li> </ol>		

DEPOSIT ACCOUNT USE  
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U.S. APPLICATION NO. (if known, see 37 C.F.R. 1.5)	INTERNATIONAL APPLICATION NO. PCT/FR96/02035	ATTORNEY'S DOCKET NUMBER 100983	
17. <input checked="" type="checkbox"/> The following fees are submitted:		CALCULATIONS	PTO USE ONLY
<b>Basic National fee (37 CFR 1.492(a)(1)-(5)):</b> Search Report has been prepared by the EPO or JPO.....\$930.00 International preliminary examination fee paid to USPTO (37 CFR 1.482).....\$720.00 No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2)).....\$790.00 Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO.....\$1,070.00 International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4).....\$ 98.00		\$930.00	
<b>ENTER APPROPRIATE BASIC FEE AMOUNT =</b>		\$930.00	
Surcharge of \$130.00 for furnishing the oath or declaration later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(e)).		\$	
Claims	Number Filed	Number Extra	Rate
Total Claims	13- 20 =	0	X \$ 22.00
Independent Claims	3- 3 =	0	X \$ 82.00
Multiple dependent claim(s)(if applicable)		+ \$270.00	\$
<b>TOTAL OF ABOVE CALCULATIONS =</b>		\$930.00	
Reduction by 1/2 for filing by small entity, if applicable. Verified Small Entity Statement must also be filed. (Note 37 CFR 1.9, 1.27, 1.28). -		\$	
<b>SUBTOTAL =</b>		\$930.00	
Processing fee of \$130.00 for furnishing the English translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 month from the earliest claimed priority date (37 CFR 1.492(f)). +		\$	
<b>TOTAL NATIONAL FEE =</b>		\$930.00	
		Amount to be refunded	\$
		Charged	\$
a. <input checked="" type="checkbox"/> Check No. <u>60532</u> in the amount of <u>\$930.00</u> to cover the above fees is enclosed.			
b. <input type="checkbox"/> Please charge my Deposit Account No. _____ in the amount of \$_____ to cover the above fees. A duplicate copy of this sheet is enclosed.			
c. <input checked="" type="checkbox"/> The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment, to Deposit Account No. <u>15-0461</u> . A duplicate copy of this sheet is enclosed.			
<b>NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.</b>			
SEND ALL CORRESPONDENCE TO: OLIFF & BERRIDGE, PLC P.O. Box 19928 Alexandria, Virginia 22320			
 NAME: William P. Berridge REGISTRATION NUMBER: 30,024			
NAME: Joel S. Armstrong REGISTRATION NUMBER: 36,430			

09/101508

23 Recd PCT/PTO 30 SEP 1998

PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of

Jean-Louis BOYER et al.

Application No.: 09/101,508

Filed: July 13, 1998

Docket No.: 100983

For: PROGRAMMABLY TIMABLE PRIMING DEVICE

115

PRELIMINARY AMENDMENT

Assistant Commissioner of Patents  
Washington, D. C. 20231

Sir:

Prior to initial examination, please amend the above-identified application as follows:

IN THE ABSTRACT:

Please substitute the attached Abstract for the Abstract filed with the application.

IN THE SPECIFICATION:

Page 1, below the title, insert:

--BACKGROUND OF THE INVENTION

1. Field of the Invention--;

between lines 5 and 6, insert:

--2. Description of the Related Art--;

line 8, change "Said timing" to --Timing--;

line 10, change "said" to --the--;

line 12, change "2 670 576" to --No. 2670576--;

line 13, delete "or".

Page 2, before line 1, insert:

--SUMMARY OF THE INVENTION--.

line 4, change "said" to --the--;  
line 6, change "said" to --the--;  
line 7, change "said" to --the-- (both occurrences);  
line 8, change "said" to --the--;  
line 14, change "said" to --the-- (both occurrences);  
line 15, change "said" to --the-- (both occurrences);  
line 16, change "said" to --the--;  
line 17, change "being constituted by" to --comprising--;  
line 18, change "can be constituted" to --may comprise--, and delete "by";  
line 21, change "said" to --the--;  
line 22, change "Said means can" to --The means may comprise--;  
line 23, delete "consist of".

Page 3, line 1, change "said means consist of" to --the means comprises--;

line 3, change "constituted by" to --comprising--;  
line 6, change "can consist of" to --may include--;  
line 10, change "consists" to --comprises--;  
line 11, delete "in";

between lines 11 and 12, insert:

--BRIEF DESCRIPTION OF THE DRAWINGS--;

between lines 21 and 22, insert:

--DESCRIPTION OF THE PREFERRED EMBODIMENTS--;

line 23, change "Said" to --The--.

Page 4, line 3, change "are constituted by" to --comprises--;  
line 5, change "are constituted by" to --comprises--;  
line 12, change "said" to --the--;  
line 13, change "are constituted by" to --comprises--;  
line 14, change "Said" to --The--;  
line 17, change "said" to --the--; and delete "constituted";  
line 18, change "by" to --including--;  
line 20, change "said" to --the--;  
line 22, change "constituted by" to --comprising--.

Page 5, line 3, change "are constituted by" to --comprises--;  
line 14, change "constituted by" to --comprising--;  
line 18, change "are constituted by" to --comprises--;  
line 23, change "are constituted by" to --comprises--.

Page 6, line 2, delete "are";  
line 3, change "constituted by" to --comprises--;  
line 8, change "can be constituted by" to --may comprise--;  
line 9, change "said" to --the--;  
line 14, change "Said" to --The--; and change "being constituted by" to  
--include--.

Page 7, line 8, change "Said" to --The--; and delete "is";  
line 9, change "constituted by" to --comprises--;  
line 10, change "comprising" to --comprises--;  
line 12, change "said" to --the--.

Page 8, line 8, change "said" to --the--;  
line 11, change "said" to --the--;

line 21, change "said" to --of the--.

Page 9, line 6, change "said" to --the--;

line 11, change "said" to --the--;

line 16, change "said" to --the--.

Page 10, line 11, change "are constituted by" to --comprises--;

line 19, change "said" to --the--;

line 23, change "constitute" to --comprise--.

Page 11, line 3, change "consists in" to --comprises--;

line 6, change "said" to --the--;

line 14, change "Said" to --The--.

IN THE CLAIMS:

Please cancel claims 1-13 without prejudice or disclaimer.

Please add claims 14-29 as follows:

--14. A priming device for a detonator, comprising:

timing means for timing the action of a firing element of a primer; and

an electrical power supply that provides a first power intensity to the timing means and power generating means, the power generating means capable of generating a second power intensity sufficient to actuate the firing element upon expiration of a timing interval as determined by the timing means, and the first power intensity from the power supply is not sufficient to actuate the firing element.--

--15. The device of claim 14, wherein the power generating means comprises a capacitor, switching means, and controlling means, the controlling means controlling the switching means by allowing the capacitor to be charged for a charging time and then discharged, the discharge causing the firing element to act on the primer.--

--16. A priming device for detonator, comprising:  
an electrical power supply means for timing the action of a firing element of a  
primer; and  
power generating means capable of generating a power intensity sufficient to  
actuate the firing element upon expiration of a timing interval, an intensity sufficient to  
actuate the firing element, the power generating means comprising a capacitor, switching  
means, and controlling means for controlling the switching means by allowing the capacitor  
to be charged for a charging time and then discharged, the discharge causing the firing  
element to act on the primer.--

--17. The device of claim 16, wherein the control means comprises a  
microcontroller.--

--18. The device of claim 17, wherein the switching means comprises transistors.--

--19. The device of claim 17, wherein the timing means have programming means  
for programming the timing interval.--

--20. The device of claim 19, wherein the programming means have at least one  
code wheel electrically connected to the microcontroller.--

--21. The device of claim 20, wherein the code wheel is luminescent.--

--22. The device of claim 19, wherein the programming means comprises external  
programming means and information transferring means for transferring programmed data  
from the external programming means to the microcontroller.--

--23. The device of claim 22, wherein the external programming means comprises  
an electrical power supply, a microcontroller, a display, and two programming switches.--

--24. The device of claim 22, wherein the information transferring means comprises  
phototransistors.--

--25. The device of claim 22, wherein the external programming means comprises a  
microcomputer.--

--26. The device of claim 22, wherein the information transferring means comprises an electrical connector connected to the microcontroller.--

--27. The device of claim 16, wherein the switching means comprises a mechanical timing means.--

--28. The device of claim 16, further comprising booby-trap means for deliberately authorizing firing of the primer.--

--29. The device of claim 28, wherein the booby-trap means comprises a tripwire connected to the microcontroller.--

REMARKS

Claims 14-29 are pending in this application. By this Amendment, the specification, Abstract are amended, claims 1-13 are canceled and claims 14-29 are added.

The specification is amended to place the text in proper idiomatic English and to better comport with U.S. practice. Applicants respectfully submit that no new matter has been added to the specification. Claims 1-13 are canceled and claims 14-29 are added to clarify the invention and to better comport with U.S. practice.

Prompt and favorable examination on the merits is respectfully requested.

Respectfully submitted,



William P. Berridge  
Registration No. 30,024

Ronald E. Prass, Jr.  
Registration No. 42,089

WPB:REP/geh

Attachment:

Substitute Abstract

OLIFF & BERRIDGE, PLC  
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### ABSTRACT OF THE DISCLOSURE

The invention relates to the field of electrical firing mechanisms, and more particularly to a priming device of a detonator. The priming device includes an electrical power supply that provides a first power intensity to a circuit. The circuit 5 powered includes a timing device for timing the action of a firing element of a primer, and a power generating device that upon expiration of a timing interval, provides a second power intensity sufficient to actuate the firing element and the first power intensity from the power supply is not sufficient to actuate the firing element.

PROGRAMMABLY TIMABLE PRIMING DEVICE

The present invention relates to the field of electrical firing mechanisms, and more particularly that of priming devices of an ignition detonator for miniature bombs, projectiles, missiles, and mines, having an electrical power supply and means for timing the action of a firing element of a primer.

It is known to use priming devices having means for timing the action of a firing element of the primer.

Said timing means are generally electronic, and failure thereof can result in premature action of the element on the primer, and thus in explosion of the weapon with which they are associated. It is self-evident that said explosion can have serious consequences for the user or users.

To avoid this problem, French Patent 2 670 576 describes a neutralization device or for weapons, having a housing, a pyrotechnic chain deactivated by mechanical safety means (in this instance a clock), and a timer which can be controlled by transmission means.

A device of this kind has a drawback, however, when it is desired to prime several neutralization devices simultaneously. The reason is that each of the timers must be programmed while taking into account the time used to program the previous ones. Such programming cannot therefore be other than imprecise, and leads to successive explosions because it does not allow for multiple simultaneous firings.

One of the purposes of the invention is to remedy these drawbacks by proposing a reliable electronic or electromechanical priming device, the timing system of which can be programmed simultaneously for multiple priming devices with the aim of achieving perfect synergy.

According to the invention, a priming device of a detonator therefore has an electrical power supply providing a first intensity to a circuit having means for timing the action of a

firing element of a primer and to means capable of generating, upon expiration of the timing interval, a second intensity sufficient to actuate said element, the first intensity emerging from the power supply not being sufficient.

According to a particular feature, said means are constituted by a capacitor, switching means, and means for controlling said switching means allowing said capacitor to be charged for a charging time ( $T_{p2}$ ), then discharged, said discharge causing the element to act on the primer.

According to another variant of the invention which allows numerous associated devices to be added, a priming device of a detonator has an electrical power supply[,] means for timing the action of a firing element of a primer, and means capable of generating, upon expiration of the timing interval, an intensity sufficient to actuate said element, said latter means having a capacitor, switching means, and means for controlling said switching means allowing said capacitor to be charged for a charging time, then discharged, said discharge causing the element to act on the primer, the control means being constituted by a microcontroller.

In addition, the switching means can be constituted, for example, by transistors.

In order to improve the operating flexibility of the device, it is preferable for the timing means to have means for programming the timing interval; said means can be entirely or partially integrated into the priming device. Said means can, for example, consist of code wheels or a microcomputer.

According to a particular feature, said means consist of external means having an electrical power supply, a microcontroller, a display, two programming switches, and transfer means constituted by phototransistors.

According to another feature capable of preventing neutralization of the weapon by an unauthorized person, or of deliberately anticipating firing, a priming device according to the invention has booby-trap means which can consist of a circuit comprising switching means,

the opening of which causes the primer to fire.

Lastly, another object of the invention is a method for safing a priming device of a detonator, of the type having an electrical power supply and means for timing the action of a firing element of the primer, wherein the method consists, upon expiration of the timing interval, in charging a capacitor and then discharging it to cause firing.

Other advantages and features of the present invention will be apparent from the description of several variant embodiments with reference to the attached drawings, in which:

Figure 1 depicts a simplified general diagram of the device according to the invention;

Figure 2 shows a diagram of the principal programming means;

Figure 3 depicts a variant embodiment of the invention;

Figure 4 shows a diagram of the external programming means according to a particular variant embodiment of the invention; and

Figure 5 shows a particular embodiment of the invention.

Figure 1 shows a diagram of the principal constituent means of a firing device of a primer of a detonator according to the invention. Said means are of the type having a housing within which are arranged electrical power supply means 10 for a circuit comprising principally a firing resistor 12 of primer 13, circuit closing means 20, and means 30 for timing firing after the circuit is closed.

Power supply means 10 are constituted by two lithium batteries supplying a voltage of 6 V.

In this variant embodiment, circuit closing means 20 are constituted by a mechanical bolt 21 having two positions, A and C, which is connected to a U-shaped key 22 placed in a constriction on the exterior of the housing, rotation of which allows the bolt to be placed in the desired position.

As shown in Figure 2, firing timing means 30 have means 32 for programming a timing interval, means 34 for switching the circuit which supplies power to priming resistor

12, and a capacitor 36 supplying an intensity I2 as it discharges, intensity I1 of the charging current of said capacitor being insufficient to cause firing of the primer.

In this first variant embodiment, programming means 32 are constituted by code wheels 38 and a microcontroller 40. Said code wheels are luminescent, allowing programming both at night and during the day.

Microcontroller 40 controls the opening and/or closing of switching means 34.

As shown in Figure 3, said switching means 34 have first means 41 constituted by an electromechanical safety device 41 comprising a mechanical clock, associated with a mechanical changeover switch which is normally in the open position and which closes the circuit upon expiration of a predetermined operating interval of said clock.

They have second means constituted by a transistor 50 whose source is connected to power supply 10, its gate to microcontroller 40, and its drain to the input of the changeover switch of electromechanical assembly 41, and a transistor 55 whose source is connected to priming resistor 12, its gate to microcontroller 40, and its drain to the output of the changeover switch.

Third means are constituted by a timed-closure switch 65 arranged between electrical power supply 10 and microcontroller 40.

In addition, drain 53 of transistor 50 is connected to a short-circuit transistor 60 which is in turn connected to microcontroller 40 and to ground.

Moreover, resistors 70, 71, 72 limiting the current intensity are located in the circuit upstream from the electromechanical means and between the microcontroller and transistor 55, so that in the event the transistors and the electromechanical means fail, the current passing through priming resistor 12 is of an intensity insufficient to cause priming of the detonator.

Furthermore, signaling means 81 and 80 are arranged respectively downstream from timed-closure switch 65 and in parallel with priming resistor 12.

Lastly, means 35 constituted by elements 10 and 36 are capable of generating, upon expiration of the timing interval, an intensity I2 sufficient to actuate priming resistor 12, power supply 10 providing an intensity I1 capable of charging the capacitor and the latter supplying an intensity I2 when it discharges.

With this embodiment, in which the programming means are constituted by code wheels 38, when mechanical bolt 21 is in position A all the electronic means are grounded; while in position C, all the electronic means are powered, but capacitor 36 is not in any case connected to the power supply circuit until after a safety delay time generated by electromechanical safety device 41.

In a second variant embodiment, the programming means are constituted by an external programming device 100 and by information transfer means, by direct contact such as an RS232 connector, or of the transmission/reception type, for example using phototransistors. In this instance the circuit closing means are preferably constituted by a mechanical bolt 21 having three positions, A, B, and C: a position A in which all the electronic means are grounded; a position B in which capacitor 36 is grounded and power is supplied to the other electronic means; and a position C which follows position B and in which capacitor 36 is connected to the circuit after a safety delay time generated by electromechanical safety device 41.

External device 100 can be constituted by a microcomputer of the portable type into which a program is loaded, said program allowing the user to indicate, in particular, the firing time either in the form of a date, which then requires entry of the programming date if it does not already exist in the microcomputer, or in the form of a delay interval. After the user has confirmed the programming, the data are transferred via an RS232 connector to one or more priming devices simultaneously.

Said external device 100 can also be constituted by an assembly comprising an electrical power supply 110, a microcontroller 140, a display 145, two programming switches

146, 147, and a run/stop switch 112; and the transfer means comprise phototransistors 148, 149 associated with phototransistors arranged in the housing.

In this case, selection of parameters is accomplished via a preprogrammed drop-down menu. Data are displayed in blocks, and all the parameters associated with a block appear alongside one another, so that an overall view of the progress of each one is retained while programming the block.

There are four blocks, as follows:

DATE: corresponding to the programming date

DIRECT: the timing interval prior to priming of the detonator

CALENDAR: the date on which priming is to occur

TRANSMIT: validation of this block causes the programmed data to be transferred to the igniter.

As regards the two switches 146, 147, the function of one is to validate the data entry that is displayed and to display the first datum of the next parameter, which can be in the same block or the first one of the next block.

A booby-trap module 200, of the contact-opening type, is also added to the means described in the aforementioned first variant embodiment. Said module is constituted by a closed circuit, powered by power supply means described above, and comprising a certain number of contactors whose method of opening depends on the type of booby-trapping, which are connected to microcontroller 40. As an example, said contactors can be opened by remote control, or can be inertial, or can more simply be a tripwire resting on the ground in the vicinity of the igniter.

A device according to the invention, programming of which is accomplished by way of an external device 100, operates as follows:

The batteries are placed in the housing before it is used, and mechanical bolt 21 is in position A, means 20 and 30 thus not being supplied with electrical power.

The user then disengages key 22 from the constriction on the housing, then proceeds to turn the latter to position B in which capacitor 36 is grounded and power is applied to the other electronic means. The receiving circuit has two phototransistors 48, 49 located as close as possible to a portion of the housing which is transparent to the radiation emitted by phototransistors 148, 149 of device 100. The housing also has a notch which allows the respective phototransistors of programming means 100 and of the firing means to be positioned precisely opposite one another.

Once the run/stop switch has been closed, the microcontroller of assembly 100 causes a menu to drop down, displayed block by block on display 145, the transition to the next parameter of one block or to the next block being accomplished by actuating one of programming switches 146, 147, the other serving to validate the parameters and transmit them to the firing device.

The menu can, for example, have two blocks, one concerning the desired timing interval D1 in a day/hour/minute/second format, i.e. four parameters, and the other relating to the validation of said parameters and transmission of said parameters via phototransistors 148, 149, 48, 49.

When all the parameters have been validated, validation of the TRANSMIT block causes said parameters to be transferred from device 100 to the priming device. In return, microcontroller 40 sends back a copy of the parameters which is received by device 100, which verifies that they conform to those sent out previously, and issues a confirmation message releasing the transmission.

It is evident that when the priming time is selected in calendar mode, it is possible to transmit the same parameters, successively or simultaneously, to a plurality of priming devices, and thus to synchronize all the priming events.

The use of a microcomputer makes this synchronization operation even easier. All that is necessary is to connect the microcomputer to each of the RS232 connectors of the

various priming devices being synchronized, and then to transfer the parameters simultaneously to all said devices.

The firing means are then placed on a suitable explosive device. In the case of a mine, it can be placed on the target to be destroyed, by the user, who then proceeds to turn key 22 to position C and then withdraws it from the housing to prevent any access by an unauthorized person to bolt 21.

In this position, the countdown of the timing interval D1, which began when the transmission was released, continues, while the mechanical timing clock of the electromechanical safety means is triggered. Upon expiration of a preprogrammed operating time  $T_{p1}$  of said clock, it causes mechanical changeover switch 41 to trip, and thus causes closure of the portion of the circuit located between transistor 50 and capacitor 36.

Thus, in all cases in which timing interval D1 programmed by the user is less than preprogrammed time  $T_{p1}$ , or in cases where microcontroller 40 or transistors 50, 55, 60 fail, firing cannot in any case take place until after said time  $T_{p1}$  has elapsed.

After value D1 has counted down, microcontroller 40 deactivates short-circuit transistor 60 and activates transistor 50 which then becomes conductive. Capacitor 36 then charges, and after a preprogrammed time  $T_{p2}$ , called the capacitor charge time, has elapsed, microcontroller 40 activates transistor 55 which becomes conductive, thus allowing capacitor 36 to discharge through said transistor 55 and through priming resistor 12, the intensity  $I_2$  passing through the latter being sufficient to cause priming of the detonator.

Allowing the capacitor to charge only upon expiration of a timing period increases the reliability of the device, since no capacitor leakage current is present during that period.

Be it also noted that for safety reasons, it is preferable for capacitor charging time  $T_{p2}$  to be long as compared with its discharge time. Any malfunctions which would be expressed as simultaneous actuations of all the transducers (such as EMP or nuclear effects) would thus have no consequences.

In addition, the process of charging the capacitor can of itself meet a need for nondegradable safety. The safety time is then just shorter than the time which results in a significant capacitor charge, i.e. one capable of causing firing of the primer when it discharges. It can be adjusted via the charging current. In this case an electromechanical safety device 41 is not necessary, whether capacitor charging is performed at power-up or before firing. In applications in which the safety time is very long and/or when the booby-trap module is used, however, utilization of electromechanical safety device 41 is required.

Especially when programming means 32 are constituted by coding wheels 38 and microcontroller 40, timed-closure switch 65 can be inserted into the circuit so as to generate an additional safety delay  $T_{p3}$  before any firing when the user turns the key from position A to position C. In this variant embodiment, this delay is an operational safety delay: during this delay time, which is an integral part of interval D1, all the switching functions of transistors 50, 60, 55 of microcontroller 40 are inhibited.

Concurrently, the mechanical timing clock of electromagnetic safety means 41 is triggered. Upon expiration of a preprogrammed operating interval  $T_{p1}$  for said clock, it causes the mechanical changeover switch associated with it to trip, thus causing closure of the portion of the circuit located between transistor 50 and capacitor 36.

Switch 65 and the clock thus constitute two simultaneously triggered safety elements of different types: one electrical, which acts on microcontroller 40; and the other mechanical, which acts on capacitor 36, such that priming of the detonator cannot occur prior to the higher value of times  $T_{p1}$  and  $T_{p3}$ .

Another operating mode of the device described above consists in authorizing firing of primer 13 via booby-trap module 200 upon expiration of the longer of delays  $T_{p1}$  and  $T_{p3}$ , specifically during the entire programmed timing interval; and, if applicable, in inhibiting transistors 50 and 55 when said timing interval elapses, thus rendering the device inert and recoverable. The reaction time between actuation of the booby-trap system and firing of the

primer is, in this case, equal to  $T_p2$ .

According to a variant embodiment of the invention, the timing means can be simplified as depicted in Figure 5. The priming device then comprises an electrical power supply 310 (batteries in this instance), a timed-opening relay 330, a timed-closure relay 335, a capacitor 336, and a priming resistor 12 of primer 13.

As soon as the batteries are inserted, the two relays are energized. Since relay 330 is initially closed, the capacitor charges. Said relay 330 opens after an interval  $T_p4$ , then relay 335 closes and capacitor 336 then discharges into resistor 12, causing firing of primer 13.

In the case of priming by displacement of a mechanical element, discharge of the capacitor supplies power to a solenoid, activation of which causes release of the electromechanical element which primes the detonator.

As far as the booby-trap means are concerned, accidental breakage of the tripwire, or opening of an inertial contactor when the priming device is moved, cause priming of the detonator. For safety reasons, however, priming cannot occur before the expiration of intrinsic safety time  $T_p1$  and operational safety time  $T_p3$ , resulting from electromechanical means and/or timed switch 65.

Claims

1. A priming device of a detonator, having an electrical power supply providing a first intensity (I1) to a circuit having means (30) for timing the action of a firing element (12) of a primer (13) and to means (35) capable of generating, upon expiration of the timing interval, a second intensity (I2) sufficient to actuate said element (12), the first (I1) intensity emerging from the power supply not being sufficient.

2. The device as defined in Claim 1, wherein the means (35) are constituted by a capacitor (36), switching means (41, 50, 55), and means for controlling said switching means allowing said capacitor (36) to be charged for a charging time (Tp2), then discharged, said discharge causing the element (12) to act on the primer (13).

3. A priming device of a detonator, having an electrical power supply[,] means (30) for timing the action of a firing element (12) of a primer (13), and means (35) capable of generating, upon expiration of the timing interval, an intensity sufficient to actuate said element (12), said means (35) having a capacitor (36), switching means (41, 50, 55), and means for controlling said switching means allowing said capacitor (36) to be charged for a charging time (Tp2), then discharged, said discharge causing the element (12) to act on the primer (13), the control means being constituted by a microcontroller (40).

4. The device as defined in either one of Claims 2 or 3, wherein the switching means are constituted by transistors (50, 55).

5. The device as defined in any one of Claims 1 through 4, wherein the timing means have means (32) for programming the timing interval.

6. The device as defined in Claim 5, wherein said programming means (32) have at least one code wheel (38) electrically connected to the microcontroller (40).

7. The device as defined in Claim 6, wherein the code wheel (38) is luminescent.

8. The device as defined in Claim 5, wherein said programming means have

external programming means (100) as well as means (101) for transferring programmed data from said external means to the microcontroller (40).

9. The device as defined in Claim 8, wherein the external means have an electrical power supply (110), a microcontroller (140), a display (145), two programming switches (146, 147); and the transfer means are constituted by phototransistors (48, 49, 148, 149).

10. The device as defined in Claim 8, wherein the external programming means (100) are constituted by a microcomputer; and the information transfer means (101) have an electrical connector connected to the microcontroller (40).

11. The device as defined in any one of the foregoing claims, wherein it has mechanical timing means (41).

12. The device as defined in any one of Claims 4 through 11, wherein it has booby-trap means (200) or means for deliberately anticipating firing of the primer (13).

13. The device as defined in the previous claim, wherein said booby-trap means have a tripwire connected to the microcontroller (40).

## PATENT APPLICATION

GOVERNMENT OF FRANCE, represented by the Délégué Général pour l'Armement

and

Société Jason Engineering S.A.

(Inventors: Messrs. Boyer and Gilson)

for

Programmably timetable priming device

Abstract

The invention relates to the field of electrical firing mechanisms, and more particularly to a priming device of a detonator, having an electrical power supply providing a first intensity (I1) to a circuit having means (30) for timing the action of a firing element (12) of a primer (13) and to means (35) capable of generating, upon expiration of the timing interval, a second intensity (I2) sufficient to actuate said element (12), the first (I1) intensity emerging from the power supply not being sufficient.

Figure 3

PL. 1/3

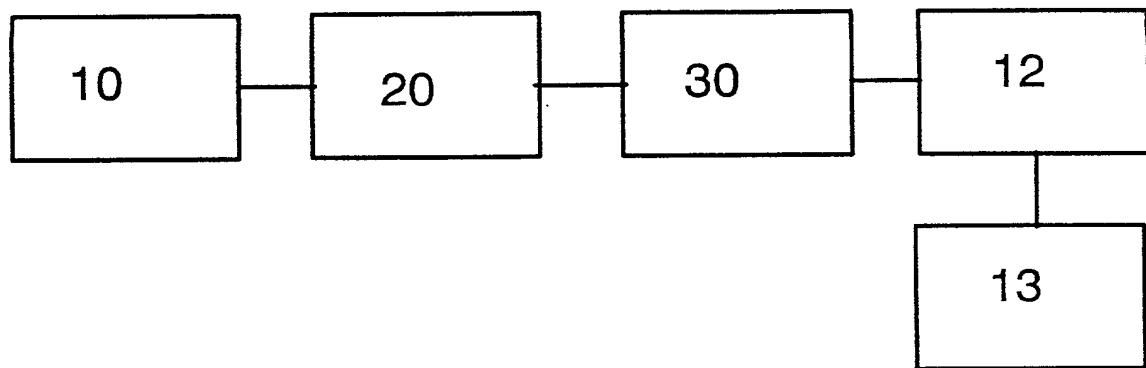


FIG. 1

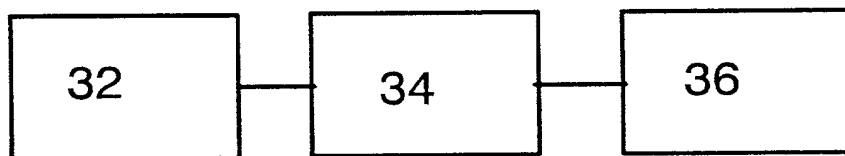


FIG. 2

100

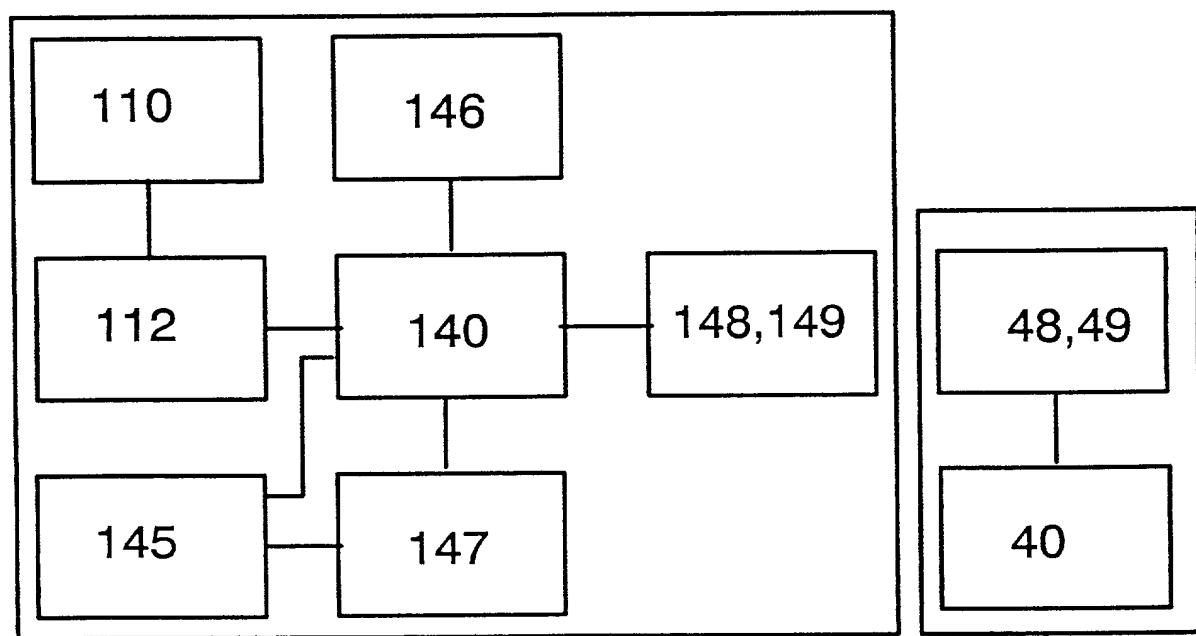


FIG. 4

PL.2/3

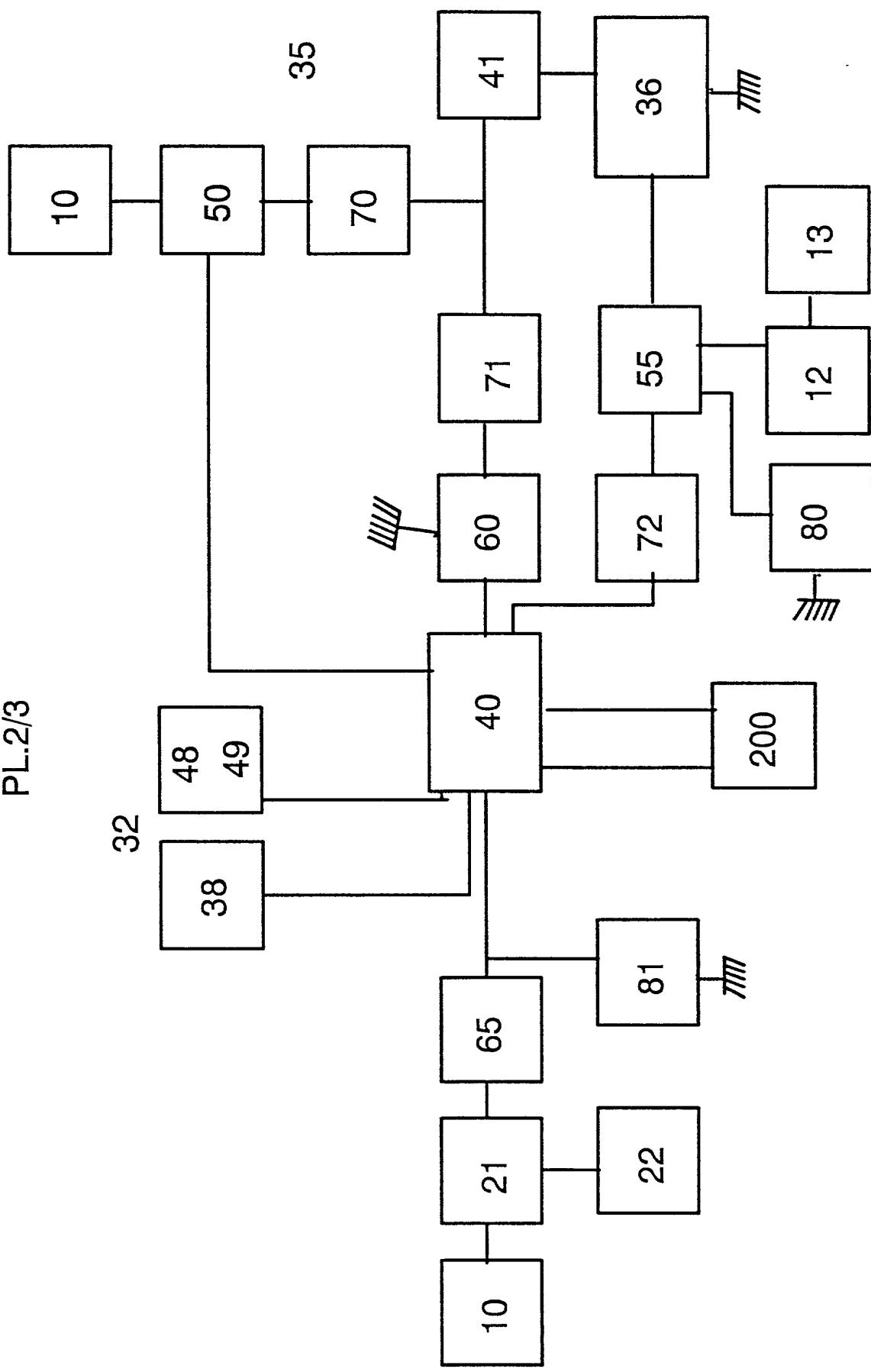


FIG.3

1508

PL. 3/3

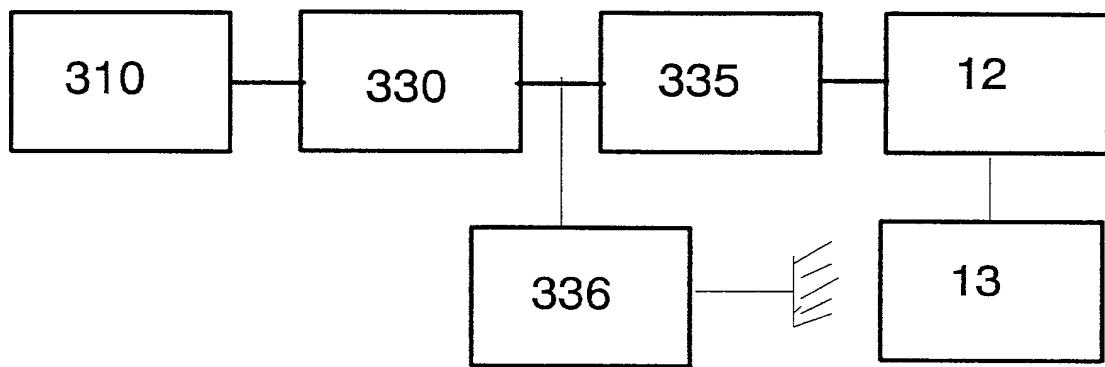


FIG. 5

**DECLARATION AND POWER OF ATTORNEY  
UNDER 35 USC §371(c)(4) FOR  
PCT APPLICATION FOR UNITED STATES PATENT**

As a below named inventor, I hereby declare that:  
my residence, post office address and citizenship are as stated below under my name;

I verily believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought, namely the invention entitled: PROGRAMMABLY TIMABLE PRIMING DEVICE described and claimed in international application number PCT/FR96/02035 filed December 20, 1996.

I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose to the Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations §1.56.

Under Title 35, U.S. Code §119, the priority benefits of the following foreign application(s) filed within one year prior to my international application are hereby claimed:

French Patent Application No. 95 15229 filed December 21, 1995

The following application(s) for patent or inventor's certificate on this invention were filed in countries foreign to the United States of America either (a) more than one year prior to my international application, or (b) before the filing date of the above-named foreign priority application(s):

I hereby appoint the following as my attorneys of record with full power of substitution and revocation to prosecute this application and to transact all business in the Patent Office:

*J* James A. Oliff, Reg. No. 27,075; William P. Berridge, Reg. No. 30,024;  
Kirk M. Hudson, Reg. No. 27,562; Thomas J. Pardini, Reg. No. 30,411;  
Edward P. Walker, Reg. No. 31,450; Robert A. Miller, Reg. No. 32,771; and  
Mario A. Costantino, Reg. No. 33,565.

ALL CORRESPONDENCE IN CONNECTION WITH THIS APPLICATION SHOULD BE SENT TO OLIFF & BERRIDGE, PLC, P.O. BOX 19928, ALEXANDRIA, VIRGINIA 22320, TELEPHONE (703) 836-6400.

I hereby declare that I have reviewed and understand the contents of this Declaration, and that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

<i>JL</i>		<i>Jean-Louis</i>	<i>BOYER</i>
1	<i>Inventor's Signature</i>	Given Name	Middle Initial
2		<i>Jean - Louis</i>	<i>BOYER</i>
3	Date of Signature	September	15
		Month	Day
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	Citizenship:	City	State or Province
	Post Office Address: (Insert complete mailing address, including country)	<i>L'Ermitage "Les Pourcieux"</i>	
		<i>Vallon de Vandrecge, 83610 Collobrieres, FRANCE</i>	

Note to Inventor: Please sign name on line 2 exactly as it appears in line 1 and insert the actual date of signing on line 3.

IF THERE IS MORE THAN ONE INVENTOR USE PAGE 2 AND PLACE AN "X" HERE

(Discard this page in a sole inventor application)

1	<i>Typewritten Full Name of Joint Inventor</i>	Andre	Joseph Nestor	GILSON
2	Inventor's Signature:	Given Name <i>Andre</i>	Middle Initial <i>J. N.</i>	Family Name <i>GILSON</i>
3	Date of Signature:	September	15	1998
Residence:		Month <i>Brussels</i>	Day	Year <i>BELGIUM BE</i>
Citizenship:		City <i>Belgium</i>	State or Province	
Post Office Address: (Insert complete mailing address, including country)		14, Boulevard Brandt Whitlock B-1200 Brussels, BELGIUM		
1	<i>Typewritten Full Name of Joint Inventor</i>	Given Name	Middle Initial	Family Name
2	Inventor's Signature:			
3	Date of Signature:	Month	Day	Year
Residence:		City	State or Province	
Citizenship:			Country	
Post Office Address: (Insert complete mailing address, including country)				
1	<i>Typewritten Full Name of Joint Inventor</i>	Given Name	Middle Initial	Family Name
2	Inventor's Signature:			
3	Date of Signature:	Month	Day	Year
Residence:		City	State or Province	
Citizenship:			Country	
Post Office Address: (Insert complete mailing address, including country)				
1	<i>Typewritten Full Name of Joint Inventor</i>	Given Name	Middle Initial	Family Name
2	Inventor's Signature:			
3	Date of Signature:	Month	Day	Year
Residence:		City	State or Province	
Citizenship:			Country	
Post Office Address: (Insert complete mailing address, including country)				

Note to Inventor: Please sign name on line 2 exactly as it appears in line 1 and insert the actual date of signing on line 3.

This form may be executed only when attached to the first page of the Declaration and Power of Attorney of the application to which it pertains.